

Attachment 9
SAMPLING AND ANALYSIS PLAN

SAMPLING AND ANALYSIS PLAN

1.0 Introduction

This SAP describes the proposed soil sampling methodology for the three treatment sites located at the UTTR-North TTU. The SAP supports the RCRA Subpart X Permit Application for the TTU. The SAP was developed to ensure that sufficient samples are taken to draw statistical conclusions concerning potential contamination and to statistically demonstrate the migration potential of all waste constituents. Where applicable, the procedures and QA/QC techniques in the current version of EPA "Test Methods for Evaluating Solid Waste" are used.

2.0 UTTR-North TTU Description

2.1 Site History

The TTU has been treating solid PEP items for more than 30 years using both OB and OD thermal treatment processes. As stipulated by OO-ALC Regulation 136-2, the materials accepted are:

Unserviceable or excess solid propellant components and associated residue for which a USAF contract exists and the contractor requests treatment assistance;

Unserviceable or explosive propellant components and associated residue owned by DoD but manufactured under non-USAF contracts and for which a treatment request exists;

Unserviceable or excess air munitions and explosive materials consisting of bulk explosives, small arms munitions, projectiles, flares, grenades, submunitions, and bombs;

Explosive residues generated from OO-ALC testing facilities and laboratories; and

Explosive scrap and residue munitions material approved for treatment on an authorized turn-in document or on an AF Form 191, "Ammunition Disposition Report."

The frequency of treatment varies according to the quantity of munitions declared unserviceable or excess during any given time period. Details regarding quantities treated and frequency of treatment can be found in Section C of the permit application. OB treatment is restricted to February 22 through December 19 in order to take advantage of favorable weather conditions.

2.2 Site Description

The TTU occupies approximately 2 square miles in a gently southwestward sloping valley. This area is located approximately 5 miles northeast of the UTTR-North support facility (Oasis) and 20 miles north of Utah Exit 62 on Interstate 80. Access to the TTU is provided via Box Elder County Road, which runs from Interstate 80 northward to the Southern Pacific Railroad work site at Lakeside. Figure 1 shows the location of the TTU.

The TTU contains three sites used for treating waste ordnance by OB and/or OD. The TTU also has a hazardous waste accumulation point for residue generated during OB/OD operations. The three sites are shown in Figure 2. Site 1 is the rocket motor and scrap propellant OB pad. Site 2 consists of three pads used as staging areas for munitions treated by OB/OD in areas adjacent to those pads. Actual operations take place on the soils immediately to the west of each pad. Site 3 is the munitions burn pan where small arms ammunition, flares, CADs, and PADs are demilitarized by OB. This burn pan is located approximately 150 ft southeast of the burn pit it replaced.

All the OB and/or OD operations performed at Sites 1 and 2 are conducted by placing waste munitions items on ground level and initiating or detonating the materials to be treated using explosive charges. There are no engineered structures or containment facilities in place at these two sites; therefore, the release of contaminants into the surrounding area is possible. All OB operations at Site 3 are conducted in a burn pan. Therefore, the only potential for contamination

Figure 1. Location of the TTU in the UTTR-North

Figure 2. UTTR-North TTU

is residue that may be carried off by the wind. Due to the low water table levels (see Attachment 1, Section 4.1), groundwater contamination from OB/OD activities at the TTU is not likely. A brief description of each site is provided below (also see Section B-2 of the permit application for more details).

2.2.1 Site 1

Site 1, centered at 41° 8' 13.58" North latitude and 112° 53' 41" West longitude, was built in 1989 and is an OB pad used for thermal treatment of solid rocket propellants. OD does not take place at this location. The pad consists of a filled and raised area, with dimensions 300 ft north to south and 400 ft east to west. The surface of the OB pad consists of 8 to 12 in. of pit-run material, covered with 6 in. of 0.75 minus crushed gravel. Grounding rods are driven into the soil for each OB event as needed, isolating the propellant from ESD. Figure 3 of Attachment 1 provides a drawing of this site.

2.2.2 Site 2

Both OB and OD operations occur at Site 2. The site was built in 1990 and consists of three separate, graveled pads with undeveloped areas immediately to the west of each pad where thermal treatment operations are conducted. A series of gravel roads connect the pads and provide site access. The pads are numbered 1, 2, and 3, from north to south. Pad 1 has approximate dimensions of 100 by 100 ft. Pad 2 is the smallest, with dimensions of about 75 by 75 ft. Pad 3 is the largest, with approximate dimensions of 150 ft north to south by 200 ft east to west. Pad 3 is preferred for use with items that fragment or require specific site preparation, such as the creation of berms. Pad 1 is centered at 41° 7' 58.05" North latitude and 112° 53' 37.03"

Figure 3. Site 1—Solid Rocket Propellants OB Unit

West longitude; Pad 2 is centered at 41° 7' 55.48" North latitude and 112° 53' 35.01" West longitude; and Pad 3 is centered at 41° 7' 51.35" North latitude and 112° 53' 3.18" West longitude.

All pads consist of 8 to 12 in. of pit-run material, covered with 6 in. of 0.75 minus crushed gravel. Site 2 pads are used for staging OB/OD operations only, providing a stable surface for off-loading conventional high explosives and large missile sections. The surficial soils in the operational areas consist of fine sandy silt with some clay. Grounding rods are driven into the soil at the operational location for each OB event, as required. Craters created by OD operations are filled in by the Oasis Civil Engineers within two weeks of the event. Figure 4 provides a drawing of this site.

2.2.3 Site 3

Site 3, the miscellaneous munitions burn pan, is located in the eastern portion of the TTU at 41° 7' 56.75" North latitude, 112° 53' 27.47" West longitude. It is located approximately 150 ft southeast of the burn pit it replaced. This pan was constructed in 1992, but not put into operation until 1996. It is approximately 7 ft wide and 20 ft long and is constructed of steel plate and concrete. The pan is used up to twice a week to treat CAD/PAD items, flares, and small arms ammunition by OB. The pan is completely surrounded by a concrete containment area and has a moveable, track-mounted lid to cover the pan between burns, keeping out precipitation and wildlife. The burn pan is ready for clean out and reuse within 24 hours after an OB operation. Figure 5 provides a drawing of this site.

2.3 Hazardous Constituents/Indicator Parameters to be Monitored

Hazardous constituents of concern are listed in Appendix VIII of 40 CFR 261. Table A-1, however, lists only these constituents monitored under this SAP. Other Appendix VIII constituents are not listed because of the following:

Knowledge of past treatment operations at the TTU;

Figure 4. Site 2_Pads 1-3 and OB/OD Operational Areas

Figure 5. Site 3—Miscellaneous Munitions Burn Pan

Table 1 List of Hazardous Constituents to be Monitored, UTTR-North TTU

Parameter/Constituent	SW-846 Analytical Method
Energetic Compounds	
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	8330
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	8330
1,3,5-Trinitrobenzene (1,3,5-TNB)	8330
1,3-Dinitrobenzene (1,3-DNB)	8330
Trinitrophenylmethylnitramine (Tetryl)	8330
Nitrobenzene (NB)	8330
2,4,6-Trinitrotoluene (2,4,6-TNT)	8330
2,4-Dinitrotoluene (2,4-DNT)	8330
2,6-Dinitrotoluene (2,6-DNT)	8330
4-Amino-2,6-Dinitrotoluene (4-Am-2,6-DNT)	8330
2-Amino-4,6-Dinitrotoluene (2-Am-4,6-DNT)	8330
2-Nitrotoluene (2-NT)	8330
3-Nitrotoluene (3-NT)	8330
4-Nitrotoluene (4-NT)	8330
Pentaerythritol tetranitrate (PETN)	8330
SVOCs	
Acenaphthene	8270A
Acenaphthylene	8270A
Anthracene	8270A
Benzo(a)anthracene	8270A
Benzo(b)fluoranthene	8270A
Benzo(k)fluoranthene	8270A
Benzo(g,h,i)perylene	8270A
Benzo(a)pyrene	8270A
Benzoic acid	8270A
Benzyl alcohol	8270A
Bis(2-chloroethoxy)methane	8270A
Bis(2-chloroethyl)ether	8270A
Bis(2-chloroisopropyl)ether	8270A
Bis(2-ethylhexyl)phthalate	8270A
4-Bromophenyl phenyl ether	8270A
Butylbenzylphthalate	8270A
4-Chloroaniline	8270A
4-Chloro-3-methylphenol	8270A
2-Chloronaphthalene	8270A
2-Chlorophenol	8270A
4-Chlorophenyl phenyl ether	8270A
Chrysene	8270A
Di-n-butyl phthalate	8270A
Di-n-octylphthalate	8270A
Dibenzo(a,h)anthracene	8270A
Dibenzofuran	8270A

Table 1 (Continued)

Parameter/Constituent	SW-846 Analytical Method
SVOCs	
1,2-Dichlorobenzene	8270A
1,3-Dichlorobenzene	8270A
1,4-Dichlorobenzene	8270A
3,3'-Dichlorobenzidine	8270A
2,4-Dichlorophenol	8270A
Diethyl phthalate	8270A
2,4-Dimethylphenol	8270A
Dimethyl phthalate	8270A
4-6-Dinitro-2-methylphenol	8270A
2,4-Dinitrophenol	8270A
2,4-Dinitrotoluene	8270A
2,6-Dinitrotoluene	8270A
Fluoranthene	8270A
Fluorene	8270A
Hexachlorobenzene	8270A
Hexachlorobutadiene	8270A
Hexachlorocyclopentadiene	8270A
Hexachloroethane	8270A
Indeno(1,2,3-cd)pyrene	8270A
Isophorone	8270A
2-Methylnaphthalene	8270A
2-Methylphenol	8270A
4-Methylphenol	8270A
Naphthalene	8270A
2-Nitroaniline	8270A
3-Nitroaniline	8270A
4-Nitroaniline	8270A
Nitrobenzene	8270A
2-Nitrophenol	8270A
4-Nitrophenol	8270A
N-Nitroso-di-n-propylamine	8270A
N-Nitrosodiphenylamine	8270A
Pentachlorophenol	8270A
Phenanthrene	8270A
Phenol	8270A
Pyrene	8270A
1,2,4-Trichlorobenzene	8270A

**Table 1
(Continued)**

Parameter/Constituent	SW-846 Analytical Method
2,4,5-Trichlorophenol	8270A
2,4,6- Trichlorophenol	8270A
Toxic Metals	
Aluminum	6010A
Antimony	6010A
Beryllium	6010A
Cadmium	6010A
Chromium (total)	6010A
Cobalt	6010A
Copper	6010A
Iron	6010A
Lead	6010A
Magnesium	6010A
Manganese	6010A
Mercury	7470A/7471A
Nickel	6010A
Selenium	6010A
Silver	6010A
Vanadium	6010A
Zinc	6010A

The types, quantities, and concentrations of constituents likely to be present in the wastes to be treated in the OB and OD units at the TTU;

Constituents previously detected; and the potential for any adverse effects on human health and the environment.

3.0 Environmental Setting

3.1 Physiography/Topography

The TTU is located in a broad, gently sloping valley in the Lakeside Mountains, which opens to the southwest. The Lakeside Mountains are highly faulted and composed of Paleozoic limestone and dolomite with minor amounts of sandstone, quartzite, and shale. The valley fill is typically Lake Bonneville deposits of clay and silty clays in mud flats, fine silty sand and clayey silt in dunes, and silty sand-gravelly alluvium on the mountain sides. The valley where the TTU is located is bordered on the east by a low pass known as Sedal Pass, to the west by Box Elder County Road, to the north by a steep mountainside, and to the south by an open area. The elevation of the TTU ranges from approximately 4640 ft above MSL at the southwest corner of the facility to over 5,100 ft above MSL toward the mountains, which form the northern facility boundary.

Topography and surface water and groundwater drainage patterns are shown in Figure A-2. There are no perennial streams or permanent surface water bodies in the TTU vicinity other than the Great Salt Lake, which is about 1 mile from the TTU eastern boundary. Intermittent drainages carry run-off generated by winter snows and occasional showers, which generally occur in spring and autumn. Precipitation is usually short-lived and generates only small quantities of water in this arid environment, although brief, intense thunderstorms can occur. Larger storms cause local ponding in surface depressions, but the ponds normally last only a few days due to the consistently high evaporation rates.

3.2 Geologic/Hydrogeologic Conditions

The TTU is located in the northern portion of Sink Valley. The Lakeside Mountains border this valley to the east and the Grassy Mountains border the valley to the west. The land forms are typical of the Basin and Range physiographic province, which is characterized by generally north-south trending mountain ranges separated by relatively broad alluvium-filled valleys. The

mountain ranges are composed of sequences of mainly carbonate rock. The valleys are generally filled with unconsolidated and partially consolidated sediments of alluvial and lacustrine origin. The topography of the valley floor is strongly influenced by ancient Lake Bonneville, which completely inundated the area, except for the tallest peaks in the Lakeside Mountains, approximately 15,000 years ago. The valley is filled with erosional debris washed from the surrounding mountains. Several small intermittent runnels cross the TTU and converge near the southwest corner. They drain toward the southwest in the central portion of Sink Valley in shallow dry washes that contain flowing water only during infrequent storm events (see Figure A-2). The northern portion of Sink Valley contains no surface water bodies or surface water outlets.

In the vicinity of the TTU, bedrock in the Lakeside Mountains is assigned to the Great Blue Limestone and Humbug formations. Great Blue Limestone outcrops in areas immediately north and southeast of the TTU area. The Great Blue Limestone is described as a thick-bedded to massive, dark gray limestone containing occasional beds of sandstone, shale, and fossiliferous limestone.

The geology beneath the TTU was investigated through two on-site monitoring well borings and geologic information collected at nearby Landfill 5 (see Figure A-2). Both on-site boreholes penetrated a significant thickness of alluvial valley fill material. One boring encountered a thick sequence of weathered rhyolitic tuff at a depth of approximately 400 ft, while a second boring remained in valley fill sediments to its total depth of 609 ft. In general, two geological units comprise the valley fill sediments. Gravelly deposits are found at the ground surface at elevations above 4,800 ft in the TTU area. These were described as gravel with minor sand, silt, and clay. Below the 4,800 ft elevation, the surficial soils in the TTU area consist of fine sandy silt with some clay. This finer-grained unit is thought to have been deposited by Lake Bonneville and is described as chiefly clay with silty deposits. The gravelly unit is approximately 400 ft thick beneath Sedal Pass, where it overlies a volcanic tuff, which is at least 310 ft thick, as found in the first boring. Beneath the central portion of the TTU, at the second boring, approximately 20 ft of the silty clay unit overlies the clayey gravels. At this location, the valley fill sediments extend to

a depth greater than 610 ft.

The thickness of valley fill sediments was estimated to be approximately 740 ft in the vicinity of Landfill 5. Borings in the vicinity of Landfill 5 penetrated valley fill sediments consisting of gravelly sands, silt, and clays to depths approximately 450 ft bgs.

Cementation in the sediments was identified in the clayey gravel unit. Many of the cutting fragments generated during drilling appeared to have a carbonate cement rind on the surfaces. Cementation was identified at depths below 15 ft near Sedal Pass and at depths greater than 200 ft near the center of the TTU.

4.0 Background Conditions

4.1 Groundwater Conditions/Quality

The regional groundwater conditions for the Sink Valley Hydrogeologic Basin are described in general terms based on a hydrogeologic investigation. This investigation describes the north end of Sink Valley as a separate, independent groundwater basin called the North Valley Subdistrict. Additional hydrogeologic information was noted in a Closure/Post-Closure Plan for Landfill 5.

The principal aquifer within the North Valley Subdistrict is composed of silty sand and gravel deposits in the older (deeper) valley fill. Groundwater in the valley fill occurs under both water table (unconfined) and artesian (confined) conditions. Groundwater quality in the principal aquifer generally ranges from 2,000 to 5,000 mg/L of TDS, which makes the water supply unsuitable for human consumption without treatment. Groundwater drawn from wells at Oasis (located approximately 5 miles to the southwest of the TTU) is treated by reverse osmosis before it is suitable for human use.

Groundwater quality in the vicinity of Landfill 5 decreases toward the center of the valley. TDS concentrations in excess of 3,000 mg/L were found in wells toward the center of the North

Valley Subdistrict, and better quality water is found nearer to the mountains and at shallow depths.

Recharge to the groundwater systems in the North Valley Subdistrict is slight. One percent of the precipitation that falls in the Sink Valley area contributes to the groundwater system. This is attributed to several factors:

The average annual precipitation is generally low throughout the basin;

The potential for evapotranspiration is high; and

The fine sandy silt and clay lake bed deposits that lie below the 4,800 ft elevation exhibit low-permeability characteristics, which tend to inhibit infiltration into the groundwater system.

The recharge that occurs enters the groundwater system along the margins of the adjacent Lakeside Mountains where coarser-grained sediments are present. Precipitation falling on the surrounding mountains probably infiltrates through fractures in the rock and through the coarser-grained sediments at the valley margins.

While drilling the monitoring well at Sedal Pass (JMM-TTU-1) (see Figure 2), groundwater under water table conditions was encountered at a depth of approximately 650 ft bgs (4,205 ft above MSL). Groundwater beneath the central portion of the TTU area (Well JMM-TTU-2) was found in artesian conditions at approximately 504 ft bgs. Approximately 27 ft of artesian head difference was noted from where water was first produced during drilling to where the static water level rose in the completed JMM-TTU-2 well. The water level in this well corresponds to an elevation of approximately 4,215 ft above MSL. The elevation of groundwater in monitoring wells in the vicinity of Landfill 5 was found to vary significantly depending on the well's location and placement of the well's screen. During an investigation in 1991, it was determined that the shallow aquifer lies at a depth of approximately 419 ft below land surface at Landfill 5, and that in some wells groundwater occurs under artesian conditions with up to 40 ft of head.

Groundwater flow typically parallels the topography, and groundwater beneath the TTU would be assumed to flow from recharge areas along the flanks of the mountains toward the center of the valley. However, analysis of the groundwater level data appears to contradict this assumption. Groundwater levels measured in the spring and summer of 1990 in JMM-TTU-1 at Sedal Pass were at an elevation of approximately 4,205 ft above MSL. This elevation is approximately 10 ft lower than the groundwater elevation beneath the central portion of the TTU as measured in JMM-TTU-2 and about 2 ft above the level of the Great Salt Lake during that time. The reason for this apparent anomaly is unknown, and based on the available data regarding water level elevations, the direction of groundwater flow in the uppermost water bearing zones under the TTU cannot be determined.

Two TTU monitoring wells (JMM-TTU-1 and JMM-TTU-2) were installed in 1991. Groundwater samples collected since 1994 were analyzed for energetics and metals. Table 2 shows the detected analytes. Samples were also collected from Well G, just outside the southeast corner of the TTU and adjacent to Landfill 5 (see Figure 2). No sampling protocol is available for past sampling practices.

Analytical results to date show seven metals (calcium, iron, magnesium, manganese, potassium, sodium, and zinc) were present in most groundwater samples taken from both wells (see Table 2). Each is commonly found in area soils. One energetic (nitrobenzene) was detected in one sample taken from one monitoring well (JMM-TTU-1). All analyses included equipment blanks and MSs and were completed by environmental laboratories certified by the State of Utah.

The information in Table 2 suggests that past TTU OB/OD activities did not contaminate the groundwater. This is to be expected because:

The groundwater in the principal aquifer is unsuitable for human consumption without treatment;

Groundwater occurs at greater than 400 to 600 ft bgs;

The average annual precipitation is generally low (i.e., approximately 6 in./year);

The potential for evapotranspiration is high; and

The soil deposits exhibit low permeability characteristics.

Therefore, groundwater sampling is not proposed as a part of this SAP since this facility does not pose an unacceptable risk to human health or the environment from this pathway.

4.2 Surface Water Conditions

As indicated in Section B of the permit application, there are no permanent surface water bodies within the confines of the TTU or in the surrounding area. There is an erosional dry wash located topographically below the TTU sites (see Figure A-2). Annual precipitation in and around the TTU is generally less than 6 in./year.

Table 2 TTU Groundwater Monitoring Well Sampling Results

Date	Well	Energetics ^a (µg/L)	Metals ^b (mg/L)						
			Cal- cium	Iron	Mag- nesium	Man- ganese	Potas- sium	Sodium	Zinc
3 February 1994	TTU-1	ND	59.0	0.085	24.5	0.023	36.4	314	ND
	TTU-2	ND	116	0.20	58.8	0.017	36.1	371	ND
11 April 1994	TTU-1	ND	61.8	ND	23.4	ND	31.2	ND	ND
	TTU-2	ND	115	ND	57.9	ND	33.4	355	ND
26 July 1994	TTU-1	ND	56.9	0.075 ^c	24.7	ND	39.1	318	ND
	TTU-2	ND	112	ND	61.2	ND	37.3	367	ND
18 October 1994	TTU-1	ND	68.3	ND	27.5	ND	38.5	319	ND
	TTU-2	ND	116	ND	61.2	ND	36.2	366	ND
3 March 1995	TTU-1	0.25 ^d	61.1	ND	26.2	ND	37.4	320	ND
	TTU-2	ND	119	ND	61.3	ND	36.2	371	ND
28 April 1995	TTU-1	ND	58.7	0.12	24.6	ND	36.4	309	0.019
	TTU-2	ND	115	ND	61.0	ND	36.1	367	ND
27 July 1995	TTU-1 ^e	-	-	-	-	-	-	-	-
	TTU-2 ^e	-	-	-	-	-	-	-	-
23 October 1995	TTU-1	ND	58.5	ND	24.6	ND	36.1	307	0.010
	TTU-2 ^f	ND	107	ND	54.6	ND	31.9	325	0.23
12 January 1996	TTU-1 ^f	ND	61.8	ND	26.2	ND	37.1	322	ND
	TTU-2 ^f	ND	119	ND	61.3	ND	35.6	371	0.33
4 April 1996	TTU-1 ^f	ND	54.4	ND	23.0	ND	33.9	282	0.014
	TTU-2 ^f	ND	105	ND	54.9	ND	32.5	330	0.16
26 April 1997	TTU-1 ^f	ND	62.1	ND	25.7	ND	36.5	304	0.084
	TTU-2 ^f	ND	108	ND	57.7	ND	33.8	335	0.014

^a Energetics sampled include: picric acid; nitroglycerine; PETN; nitroguanidine; nitrobenzene; 2,4-DNT; 2,6-DNT; 2,4,6-TNT; RDX; HMX; 2-amino-4,6-DNT. ^b Metals sampled include aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper; iron, lead, magnesium, manganese, mercury, molybdenum, nickel, potassium, selenium, silver, thallium, vanadium, and zinc. ^c Comparable level in the equipment blank suggests this value may be biased high.

^d Nitrobenzene.

^e TTU-1 and TTU-2 not sampled.

^f Sampled for dissolved metals.

Because the TTU sites are located near the top of the precipitation catchment basin, there is little potential for surface water run-off entering the sites. In addition, as shown in Figure A-2, a distance of more than 0.5 mile lies between the closest site and the dry wash. Surface water is present in the dry wash infrequently during major storm events, and the natural topography directs the flow away from active portions of the TTU.

The closest surface water body to the TTU is the Great Salt Lake, which lies approximately 1 mile eastward. Because the TTU is located on the west side of the Lakeside Mountain Range, surface water run-off from the TTU facility is directed to the west, away from the Great Salt Lake, into the Sink Valley, which is a closed, internally drained basin.

For these reasons, surface water resources in the vicinity will not be affected by OB/OD operations at the TTU. In addition, there are no known surface water pathways from the TTU sites to any human or environmental receptors. Therefore, surface water sampling is not proposed as a part of this SAP.

4.3. Soils Condition/Quality

Information regarding the chemical nature of surface soils was obtained through two soil sampling programs conducted at the TTU. In the first program, conducted in 1989, five samples were collected in a preliminary study of the munitions burn pit adjacent to what is now Site 3. These samples were analyzed for SVOCs and metals. Four of the five samples were taken from the top 2 in. of soil in the bottom of the pit. The fifth sample was taken to represent background conditions approximately 150 to 200 yards southeast of Site 3. The results from this first program are presented in Tables A-3 and A-4. Only those compounds found above their respective detection limits for at least one of the samples are shown. Acenaphthene, anthracene, bis(2-ethylhexyl)phthalate, dibenzofuran, fluorene, 2-methylnaphthalene, naphthalene, phenanthrene, and pyrene were present in detectable concentrations. None of these compounds are classified as

Table 3
1989 Soil Sampling Results for SVOCs and Miscellaneous Compounds

Compound	TTU-SS01S (mg/kg)	TTU-SS02S (mg/kg)	TTU-SS03S (mg/kg)	TTU-SS04S(D) (mg/kg)	TTU-SS05S (mg/kg)	TTU-SS06S(BG) (mg/kg)
Acenaphthene	ND	2J	24	ND	11	ND
Anthracene	ND	ND	3.6J	3.7J	ND	ND
bis (2-Ethylhexyl) phthalate	0.15JB	1.2JB	1.5JB	ND	0.37JB	ND
Dibenzofuran	ND	0.64J	12J	10J	5.2J	ND
Fluorene	ND	1.7J	33	26	18	ND
2-Methylnaphthalene	0.41J	18J	170	150	77	ND
Naphthalene	0.32J	3.6J	53	47	23	ND
Phenanthrene	0.38J	8.9J	92	60	51	ND
Pyrene	ND	1.0J	5.4J	4.8J	3.5J	ND
Nitrate	1.5	1.6	1.8	1.6	8.5	5.4
Total petroleum hydrocarbons	210	4,800	47,000	47,000	38,000	20

Source: SAIC 1989.
B = detected in laboratory blank
ND = not detected
J = estimated concentration

Table 4
1989 Soil Sampling Results for Heavy Metals

Compound	TTU-SS01S (mg/kg)	TTU-SS02S (mg/kg)	TTU-SS03S (mg/kg)	TTU-SS04S(D) (mg/kg)	TTU-SS05S (mg/kg)	TTU-SS06S(BG) (mg/kg)
Aluminum	7980E	9280E	9950E	8630E	9340E	14,600E
Antimony	<1.7	6.4B	<1.7	<1.7	<1.6	<1.7
Arsenic	5.7	7.0S	9.6S	7.0	7.4	5.9
Barium	153N	162N	161N	136N	159N	181N
Beryllium	<0.17	<0.15	<0.17	<0.17	<0.16	0.30B
Cadmium	<0.84	2.1	0.98	<0.87	0.83	0.90
Chromium	9.7	23.6	10.8	8.3	9.0	12.6
Copper	78.0E*	94.7E*	15.3E*	82.6E*	83.7E*	14.1E*
Lead	24.8*	811S*	160*	111*	18.5*	16.1*
Manganese	181E	219E	189E	139E	219E	345E
Nickel	9.0N	10.2N	7.5N	6.7BN	10.4N	13.9N
Silver	<0.67N	4.0N	<0.68N	<0.70N	<0.66N	<0.66N
Thallium	0.22B	0.22B	<0.17	<0.17	0.42B	0.24B
Vanadium	14.9N	16.5N	16.4N	13.1N	17.0N	19.2N
Zinc	60.7	88.7	59.7	43.2	66.8	48.3

Source: SAIC 1989.

B = reported value is less than the contract required detection limit, but greater than the instrument detection limit

E = value is estimated due to matrix interferences

N = spiked sample recovery not within control limits

S = reported value was determined by the method of standard additions

* = duplicate analysis was not within control limits

carcinogens.

A variety of metals were detected in the surface soils. Aluminum, barium, lead, manganese, and zinc were detected at the highest concentrations. The following compounds were detected above background (i.e., the compound was present in the soils at greater than two times background): cadmium (one sample), copper (four samples), lead (three samples), and silver (one sample).

In the second soil sampling program conducted in 1991, 20 surface soil samples were collected from various locations at each site and from background locations at the TTU and analyzed for metals, explosives, and selected anions. Figure A-6 shows the sampling locations. Table A-5 summarizes the sampling locations, analytes, and concentrations of the various compounds present in these soil samples. Only those compounds found above their respective detection limits for at least one of the samples are shown.

Samples SS-1 through SS-4 were collected from Site 1. Several metals were detected, with calcium, iron, manganese, potassium, sodium, and aluminum detected at the highest concentrations. The only anomalous value was an elevated level of copper at 18,000 mg/kg for one of the samples.

Samples SS-5 through SS-9 were collected from around Site 3. SS-9 was taken from the bottom of the burn pan itself. Analyses of the Site 3 samples revealed detectable levels of various metals, as well as one explosive (HMX). Similar metals were detected at Site 3 as were found at Site 1. However, the sample collected near the west wall of Site 3 also had elevated concentrations of zinc and lead.

Samples SS-10 through SS-15 were collected from Site 2. Analysis of these samples indicates that various metals as well as several explosives (nitroguanidine, picric acid, and HMX) are present in the soils in this area. Again, similar metals were detected at Site 2 as were found at Sites 1 and 3.

Samples SS-16 through SS-20 were collected from various background locations across or near the TTU. Analysis of these samples identified various metals as well as traces of picric acid in three of the five samples. The metals detected in the background samples were similar to those detected in the samples collected at the three sites. These data suggest that the metals detected in the surface soil samples collected at the sites may be naturally occurring. In addition, a

Figure 6. Locations of Surface Soil Samples From 1991 Investigation in the TTU

Table 5 - 1991 Soil Sampling Results^a

Analyte	SS-1: Center of Site 1 Staging Area (mg/kg)	SS-2: Site 1, Rocket Motor Burn Area (mg/kg)	SS-3: Site 1, Scrap Propellant Burn Area (mg/kg)	SS-4: North Edge of Site 1 Staging Area (mg/kg)	SS-5: West Wall of Site 3 (mg/kg)	SS-6: Northwest Corner of Site 3 (mg/kg)	SS-7: West Edge of Site 3 (mg/kg)	SS-8: 100 ft. East of Site 3 (mg/kg)	SS-9: Bottom of Site 3 (mg/kg)
Barium	140	110	160	170	240	220	200	200	210
Cadmium	<1	<1	<1	<1	14	<1	<1	<1	32
Calcium	120000	190000	210000	190000	150000	140000	190000	160000	150000
Chromium	13	18	30	17	25	18	22	15	14
Copper	6	<1	18000	19	410	59	950	30	140
Iron	9600	6100	6900	7800	15000	14000	14000	11000	11000
Manganese	270	140	120	200	320	410	330	310	280
Magnesium	15000	9700	13000	14000	14000	19000	14000	14000	13000
Nickel	8	9	19	8	31	11	17	8	9
Potassium	4000	2500	1300	3400	3600	5300	3500	4400	3600
Sodium	1200	1000	580	1800	1000	1300	1300	690	1300
Aluminum	11000	7900	20000	9600	11000	16000	13000	13000	54000
Zinc	43	34	60	36	2300	130	490	63	240
Lead	12	<2	34	<2	48000	80	1500	65	140
Phosphorus	460	450	990	470	500	700	570	570	500
Mercury	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Chloride (mg/g)	0.1	<0.1	0.3	0.1	0.1	0.2	0.2	<0.1	0.3
Sulfate (mg/g)	<0.5	<0.5	16	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Nitrates (mg/g)	0.007	0.009	0.009	0.045	0.013	0.009	0.026	0.015	0.007
pH (unitless)	8.1	8.9	8.2	8	8.1	8.1	8.2	8	8.5
HMX	<3	<3	<3	<3	8	3	<3	4	<3
Nitroguanidine	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Picric acid	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2

^a The following energetic compounds were not detected: PETN; nitroglycerin; RDX; nitrobenzene; 2,4,6-TNT; 2,6-DNT; 2,4-DNT; and 2-amino-4,6-DNT

Table 5 – 1991 Sampling Results ^a

Analyte	SS-10: Center of Site 2, Pad 1 (mg/kg)	SS-11: West of Site 2, Pad 1 (mg/kg)	SS-12: Northwest Portion of Site 2, Pad 2, (mg/kg)	SS-13: Bottom of Crater Site 2, Pad 2 (mg/kg)	SS-14: Center of Site 2, Pad 3 (mg/kg)	SS-15: West Portion of Site 2, Pad 3 (mg/kg)
Barium	190	240	200	640	190	200
Cadmium	<1	<1	<1	<1	<1	<1
Calcium	120000	100000	120000	140000	130000	120000
Chromium	15	18	18	14	17	16
Copper	52	38	79	49	25	12
Iron	12000	14000	14000	12000	15000	14000
Manganese	290	480	440	350	360	410
Magnesium	16000	22000	19000	19000	18000	19000
Nickel	8	12	11	9	10	11
Potassium	4900	5500	5400	4200	5900	6300
Sodium	1400	710	1200	1300	1000	1700
Aluminum	14000	17000	20000	17000	20000	18000
Zinc	51	63	75	68	61	56
Lead	36	30	67	300	24	19
Phosphorus	460	730	590	500	660	750
Mercury	<0.05	<0.05	<0.05	0.07	<0.05	<0.05
Chloride (mg/g)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Sulfate (mg/g)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Nitrates (mg/g)	0.009	0.015	0.043	0.11	0.007	0.006
pH (unitless)	8.2	7.5	7.7	8.2	8	8.1
HMX	<3	<3	7	25	<3	<3
Nitroguanidine	0.3	<0.1	<0.1	<0.1	<0.1	<0.1
Picric acid	<0.2	0.3	<0.2	<0.2	<0.2	<0.2

^a The following energetic compounds were not detected: PETN; nitroglycerin; RDX; nitrobenzene; 2,4,6-TNT; 2,6-DNT; 2,4-DNT; and 2-amino-4,6-DNT

Table 5 – 1991 Sampling Results ^a

Analyte	SS-16: Background at Crest of Ridge Above JMM-TTU-1 (mg/kg)	SS-17: Background at South Central TTU (mg/kg)	SS-18: Background Southwest of TTU (mg/kg)	SS-19: Background Northwest of TTU (mg/kg)	SS-20: Background at North Central TTU (mg/kg)
Barium	230	210	220	180	190
Cadmium	3	<1	<1	<1	<1
Calcium	150000	66000	77000	100000	82000
Chromium	15	13	16	12	14
Copper	42	15	15	18	19
Iron	12000	13000	13000	10000	14000
Manganese	400	490	430	390	460
Magnesium	17000	22000	20000	17000	22000
Nickel	9	9	11	7	10
Potassium	4300	6100	6800	4200	5100
Sodium	560	870	910	460	580
Aluminum	14000	14000	17000	12000	15000
Zinc	67	55	55	51	57
Lead	34	36	29	28	22
Phosphorus	860	820	830	820	890
Mercury	<0.05	<0.05	<0.05	<0.05	<0.05
Chloride (mg/g)	<0.1	0.1	0.1	<0.1	<0.1
Sulfate (mg/g)	<0.5	<0.5	<0.5	<0.5	<0.5
Nitrates (mg/g)	0.004	0.011	0.01	0.008	0.008
pH (unitless)	7.4	7.7	7.8	7.4	7.5
HMX	<3	<3	<3	<3	<3
Nitroguanidine	<0.1	<0.1	<0.1	<0.1	<0.1
Picric acid	<0.2	0.4	<0.2	0.5	0.4

^a The following energetic compounds were not detected: PETN; nitroglycerin; RDX; nitrobenzene; 2,4,6-TNT; 2,6-DNT; 2,4-DNT; and 2-amino-4,6-DNT

comparison to data generated by Shacklette (1984) indicates that cadmium, copper, lead, and zinc are the metals present in the surface soils at concentrations above background throughout the western United States. This assumption will be verified as data are collected as a part of this SAP.

5.0 Sampling and Analysis Methodology Site monitoring for the TTU will include sampling and analysis of surface soil and subsurface soil in order to assess whether any hazardous wastes or hazardous constituents are emanating from the sites. All sampling and analysis activities will be conducted in accordance with EPA-approved test methods, where applicable. Soil sampling will initially be completed on a semiannual basis. If sampling results indicate that thermal treatment operations are effective and pose no risk to human health or the environment after 2 years of semiannual sampling, OO-ALC/EM will request, in writing, that the sampling frequency be decreased to annually and that the analyte list be decreased to only include those compounds that have been detected in the soils.

5.1 Soils Sampling and Analysis Procedures

This section describes the surface and subsurface soil sampling and analysis procedures to be implemented at the treatment sites within the TTU. This sampling is necessary to demonstrate that the units are operating in a manner that ensures residual waste constituents are not contaminating the soils above background levels in accordance with 40 CFR 270.23(a)(2) and 264.601, and to monitor the effectiveness of the treatment process in accordance with 40 CFR 270.23(d).

Sample Collection and Frequency_ Soils samples will be collected semiannually from the three

sites. As stated above, if after 2 years of semiannual sampling, soils sampling results indicate that there has been no impact from OB and/or OD operations, then OO-ALC/EM will request, in writing, that sampling frequency be decreased to annually and that the analyte list be decreased to only include those compounds that have been detected in the soils.

These sites have a potential for UXO to be present. EOD will conduct a surface sweep of the areas to be sampled before sampling begins. In addition, they will conduct downhole magnetometer surveys during intrusive activities (i.e., drilling of boreholes). The general procedure is to take a surface magnetometer reading, drill 2 ft, withdraw the drill, obtain a downhole magnetometer reading, and then resume drilling. This procedure will be repeated every 2 ft. If the magnetometer surveys show the potential for UXO, all intrusive activities will cease at that point and will be resumed at a point approximately 2 ft away.

Site 1—The site is an OB pad used for the thermal treatment of solid rocket propellants; OD does not take place at this location. The OB pad is 300 by 400 ft; the pad surface consists of 8 to 12 in. of pit-run material, covered with 6 in. of 0.75 minus crushed gravel. Figure A-3 shows a drawing of this site.

Four surface soil samples and four subsurface soil samples will be collected near the site. The same interval from each borehole will be composited to form two subsurface soil samples. Compositing at the same intervals will allow the evaluation of contaminant concentrations with depth. These samples will be collected from two downwind areas: an area southwest of the site (45% of hourly average surface winds) and an area northeast of the site (24% of hourly average surface winds). These represent the areas that have the highest potential for contamination. Figure A-7 provides example soil sample locations for this site. Exact sampling locations will be determined based on actual site conditions. The sampling locations will be documented using GPS or other appropriate method. Surface soil samples will be collected from 0-6 in. bgs and will be collected using a spade and stainless steel scoop. A typical garden spade will be used if necessary to remove surface vegetation, and a smaller stainless steel scoop will be used to collect

Figure 7. Site 1_Solid Rocket Propellants OB Unit Example Soil Sample Locations

the sample. Subsurface soil samples will be collected from depths of 0-2 ft and 2-4 ft using a hand auger or other appropriate method.

The soil samples will be composited, if required, by filling a properly decontaminated stainless steel tray or bowl with the samples to be composited and mixing it with a decontaminated stainless steel instrument. Sufficient mixing will be achieved by stirring the material in a circular fashion and occasionally turning the material over. The extent of the mixing required will depend on the nature of the sample and will be done to achieve a consistent physical appearance prior to filling the sample containers. Once mixing is completed, the sample will be divided in half and the containers filled by scooping sample material alternately from each half.

Site 2 The site consists of three separate graveled pads with undeveloped areas immediately to the west of each pad where OB and OD operations take place. Craters resulting from OD operations are filled in by Oasis Civil Engineers within 2 weeks of the event.

Figure A-4 shows a drawing of this site.

Each OB/OD operational area will be divided into four quadrants consistent with the EPA Soil Screening Guidance. Four composite surface and four composite subsurface soil samples will be collected from each of the three OB/OD operational areas. For each of these areas, six random surface soil samples will be collected from each quadrant and the samples composited to form four composite surface soil samples. Surface soil samples will be collected from 0-6 in. bgs. The samples will be collected using a spade and stainless steel scoop. A typical garden spade will be used if necessary to remove surface vegetation, and a smaller stainless steel scoop will be used to collect the sample.

Four soil borings per OB/OD operational area will be completed by hand auger or other appropriate method at the center of each of the quadrants. The subsurface soils will be collected from each borehole at depth intervals of 0-2 ft, 2-4 ft, 4-6 ft, and 6-8 ft. The same interval from each of the four boreholes will be composited to form four subsurface soil samples for each

OB/OD operational area. Compositing at the same intervals will allow the evaluation of contaminant concentrations with depth. Figure 8 provides example borehole and surface soil sample locations for each of the three OB/OD operational areas. Exact sampling locations will be determined based on actual site conditions. The sampling locations will be documented using GPS or other appropriate method. The subsurface soil samples will be composited as described in the Site 1 discussion. Note: Only those quadrants that were active during the previous 6-month period for each OB/OD operational area will be sampled.

Site 3_The site is a miscellaneous munitions burn pan that is approximately 7 ft wide and 20 ft long constructed of steel plate and concrete. This pan is completely surrounded by a concrete containment area and has a moveable, track-mounted lid to cover the pan between burns. Figure A-5 provides a drawing of this site.

Two surface soil samples and two subsurface soil samples will be collected from around this site. These samples will be collected from the area in the prevailing downwind directions (see wind direction discussion under Site 1) since these represent the areas that have the highest potential for contamination. Figure 9 provides example soil sample locations for this site. Exact sampling locations will be determined based on actual site conditions. The sampling locations will be documented using GPS or other appropriate method. Surface soil samples will be collected from 0-6 in. bgs and will be collected using a spade and stainless steel scoop. A typical garden spade will be used to remove the top cover of soil to the required depth (if necessary to remove surface vegetation), and a smaller stainless steel scoop will be used to collect the sample. Subsurface soil samples will be collected from depths of 0-2 ft and 2-4 ft using a hand auger or other appropriate method.

Sample Handling_Sampling tools and equipment will be protected from contamination sources before sampling and decontaminated before and between sampling points. Sample containers will also be protected from contamination sources. Sampling personnel will wear chemical-resistant gloves when handling the sampling equipment and samples. Gloves will be

decontaminated or disposed of between samples.

To prevent cross-contamination, non-disposable sampling equipment will be subject to decontamination procedures following sample collection at each location. These sampling equipment will be decontaminated in a decontamination zone. Typical steps in the decontamination process include, but are not limited to, the following:

Brush-scrub in tap water and phosphate-free detergent wash in a tub to remove any soil from the equipment;

Rinse in tap water in a separate tub;

Rinse in deionized water;

Rinse in isopropanol rinse;

Air dry in an area upwind of the decontamination process; and

Store equipment for future use after being wrapped in aluminum foil (shiny side out).

Sample Containers, Preservation, and Transportation_Sample container types and preservation methods/procedures to be used are presented in Table A-6.

At the end of each sampling day, samples requiring shipment will be repackaged in shipping containers with double bagged wet ice as specified by the laboratory and analytical protocols. The samples will be packaged to prevent leakage and breakage during shipping. Each shipping container will be sealed with a custody seal and sent the laboratory by an overnight delivery service.

Analytical Procedures_All procedures to be followed for laboratory analyses of soil samples will be performed by a Utah-certified analytical laboratory. EPA Method SW-846 addresses all procedures proposed in this SAP.

**Figure 8. Site 2—Pads 1-3 and OB/OD Operational Areas
Example Borehole and Surface Soil Sample Locations**

Figure 9. Site 3_Miscellaneous Munitions Burn Pan Example Soil Sample Locations

Table 6
Sample Container, Preservative, and Holding Times for Soils

Media	Parameter	Preservation	Holding Time	Container
Solids	Energetics	Cool 4°C	14 days to extraction 40 days until analysis	8-oz. glass jar
Solids	Metals	Cool 4°C	14 days to extraction 26 months until analysis	8-oz. glass jar
Solids	Semivolatile organics	Cool 4°C	7 days to extraction 40 days until analysis	8-oz. glass jar

The analytical methods to be conducted for the proposed hazardous constituents are presented in Table 1. These methods are appropriate for soils sampling and can accurately measure the hazardous constituents/parameters listed in the table.

6.0 Sample Handling and Chain-of-Custody

Standard chain-of-custody procedures will be followed to track possession of the samples from sample collection until analysis. A sample will be considered under custody if it is (1) in the possession of the sampling team, (2) in view of the sampling team, or (3) transferred to a secure area. An area is considered secure only when it is locked and access is controlled.

The field supervisor is responsible for custody of the collected samples in the field until they have been properly packaged, documented, and transferred to a courier or directly to the laboratory. If samples are not immediately transported to the analytical laboratory, they will remain in the custody of the field supervisor. A chain-of-custody record will be used for all samples collected under this SAP. The laboratory will follow its own internal chain-of-custody.

Sample labels will be affixed to all sample containers prior to or at the time of sampling. Sample seals will be used to detect tampering of samples prior to analysis. The seal will be attached in such a way that it is necessary to break the seal in order to open the sample container. As an alternative to using sample seals, evidence tape with the collector's initials and date may be used. Labels will be completed with black indelible ink and, at a minimum, will contain the sample identifier, date, time, sampler's initials, analysis to be conducted, preservative, site name, and type of sample.

Sample identifiers will identify the media sampled; the site number, the sample number, and date. An example identifier is "SSS11080197" (surface soil sample from Site 1, sample 1, collected 1 August 1997).

7.0 QA/QC

Field rinsates will be collected during each sampling event when non-disposable equipment is used to ensure that decontamination procedures in the field are adequate to prevent carryover of contamination from one sampling area to the next. Field rinsate blanks will be collected by rinsing cleaned equipment with American Society for Testing and Materials Type II water and collecting the run-off as a sample. Field duplicates (samples collected from the same sampling location) will be collected during each sampling event. These duplicates are used to ensure that the sampling procedure is reproducible and that the sample is representative of the location. One duplicate sample from each media will be collected.

To ensure that the established data quality objectives (DQOs) can be attained, the level of analytical quality achieved will be at least Level III. One set of samples (samples collected in any one day or one sample package) per year will undergo the more rigorous QA/QC to ensure data of Level IV data quality. The laboratory will report data equivalent to Contract Laboratory Program (CLP) Routine Analytical Services deliverables. Data will be sufficiently documented to allow personnel to review and evaluate data quality. Other samples sent for that year will be tested by the same analytical methods, but will require less QA/QC and reporting requirements to achieve Level III data quality.

7.1 Sampling DQOs

7.2

DQOs are quantitative and qualitative statements specified to ensure that data of known and appropriate quality are obtained during sampling. The overall objective of sampling is to provide an accurate, precise, and representative confirmation that the OD and OB treatment processes are not contaminating surrounding media above background levels. DQOs will be followed in terms of precision, accuracy, representativeness, completeness, and comparability (PARCC). The PARCC parameters indicate data quality. The procedures described in this subsection are

designed to obtain PARCC, for each sampling and analytical method and analysis.

7.1.1 Precision

Precision is a measure or estimate of the reproducibility of measurements under a given set of conditions. Specifically, precision is a qualitative measure of the variability of a group of measurements compared to their average value. A simple measure of precision is the standard deviation. The methods and protocols found in the most recent version of EPA SW-846 will be used by the laboratory performing the sample analyses.

The overall precision of measurement data is a mixture of sampling and analytical factors. The objective for precision in the chosen laboratory for certain samples is to equal the precision demonstrated for the CLP methods on similar samples. Laboratories commonly determine precision from duplicate samples; thus, precision is usually expressed as relative percent difference (RPD). The calculation for RPD is:

where V1 and V2 are the reported concentrations for each duplicate sample.

7.1.2 Accuracy

Accuracy is the ability to obtain a true value. The accuracy of an entire measurement system indicates any bias that exists; this is generally difficult to measure through the entire data collection process, since there are potentially many sources of error. These include the sampling process, field and laboratory cross-contamination, preservation, handling, sample matrix, sample preparation, and analytical techniques. Sampling accuracy can be assessed by evaluating the results of field blanks; and analytical accuracy, through use of known and unknown QC samples and MS samples.

Laboratory accuracy is checked by adding a known amount of surrogate compounds to a sample and ensuring that amount is recovered in the analysis. Surrogate compounds are compounds unlikely to be found in actual samples. This addition of a compound(s) is referred to as spiking, and the samples are referred to as spikes. The objective for accuracy in the chosen laboratory for certain samples is to equal the accuracy demonstrated for the CLP methods on similar samples being analyzed for similar concentrations of contaminants. Laboratory accuracy is expressed as percent recovery, calculated by:

where S_o is the background value obtained by analyzing the sample (before the spike is added), S_a is the concentration of the spike added to the sample, and S_s is the value obtained by analyzing the sample after the spike has been added.

7.1.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter most concerned with the proper design

of the sampling program. The representativeness criterion is satisfied by carefully selecting sample locations, sampling techniques, analytical techniques, and collecting a sufficient number of samples. Adherence to this plan will ensure that sufficient representativeness has been achieved.

7.1.4 Completeness

Completeness is a measure of the amount of data actually obtained as compared to the amount of data planned to be obtained. Situations sometimes arise in the field and the laboratory that may deter the progress of an investigation. Technical difficulties are sometimes encountered both in the field and in the laboratory.

Completeness is recorded in the laboratory by comparing the number of theoretically obtainable results under ideal conditions to the actual number of valid results obtained. CLP data has been found to be 80 to 85% complete on a nationwide basis; therefore, the completeness goal for this sampling effort is 80%. The percent complete is calculated by:

where N_a is the actual number of valid results obtained and N_i is the number of results that may have been obtained under ideal conditions.

7.1.5 Comparability

Comparability reflects the confidence with which data sets can be compared to each other. This is accomplished through using standard sampling techniques for all sampling events and standard analyzing techniques for all samples. Comparability is limited to the precision and accuracy parameters of PARCC, because only when these parameters are known can data sets be compared with confidence.

8.0 Health and Safety Procedures

Personnel performing sampling activities will use personal protective equipment such as rubber gloves, aprons, and eye protection, if necessary. A site safety and health plan will be completed prior to initiation of field activities.

9.0 Statistical Analysis

The soils data collected as a part of this SAP will be compared to background values to determine whether there is a statistically significant change over background and whether hazardous constituents are migrating from the OB and/or OD units. An error margin of three standard deviations will be added to the background data population, and then a statistical evaluation using the student's t-test will be conducted to determine the "significance" of the soils data as compared to the background data. The null hypothesis would be that there is no significant difference between the background data and the soils data indicating no contamination or that the hazardous constituents are not migrating from the OB and/or OD units. The determination of whether statistically significant contamination exists will be completed within 45 days after the analytical data are received by OO-ALC/EM. The data will be maintained in the facility operating record.

10.0 Notification Requirements

Within 45 days after analytical data are received by OO-ALC/EM, a determination will be made as to whether there is statistically significant evidence of contamination for each hazardous constituent listed in Table A-1.

If sampling and analysis reveal that there is a statistically significant increase of hazardous constituents from the OB and/or OD units, OO-ALC/EM will notify EPA Region VIII of this

finding in writing within 7 days. Such notification will identify what hazardous constituents have shown significant increases. In addition, within 90 days, OO-ALC/EM will submit to EPA Region VIII an application for a permit modification to modify the operating practices in order to maximize the treatment efficiency.

If there is evidence that a source other than the regulated units caused the statistically significant increase of hazardous constituent(s) near the OB and/or OD areas, or that it is an artifact caused by an error in sampling, analysis or statistical evaluation, OO-ALC/EM may make a demonstration in addition to, or in lieu of, submitting a permit modification application. In the demonstration, OO-ALC/EM must:

- Notify the State in writing within 7 days of determining a statistically significant increase near the OB and/or OD areas that they intend to make a demonstration;

- Submit a report to the State within 90 days that demonstrates that a source other than the regulated units caused the increase or that the increase resulted from an error in sampling, analysis, or evaluation;

- Submit an application for a permit modification to the State within 90 days that identifies any appropriate changes to the monitoring program; and

- Continue to monitor in accordance with this SAP.